

**INDIANA DEPARTMENT OF NATURAL RESOURCES
DIVISION OF FORESTRY
RESOURCE MANAGEMENT STRATEGY FOR INDIANA BAT
ON
INDIANA STATE FORESTS
Revised April 2001**

The Indiana Division of Forestry (DoF) recognizes the potential to enhance Indiana bat habitat on its lands by implementing comprehensive management principles. Of the numerous species of bats native to Indiana, the Indiana bat, *Myotis sodalis* is one of only two species (Gray Bat, *Myotis grisescens* is the other), that are designated as state and federally endangered.

The Indiana bat is a migratory species that is found throughout much of the eastern half of the United States. During the winter, Indiana bats are restricted to suitable hibernacula (caves and abandoned mines) that primarily are located in karst areas of east central United States. More than 85% of the range-wide population of Indiana bats occupy nine "Priority One" hibernacula (i.e., hibernacula with recorded populations of >30,000 bats since 1960) At least two of these nine "Priority One" hibernacula , and several non-Priority One hibernacula are located on or near DoF property. Based on censuses taken at all known hibernacula, the total Indiana bat population in the United States is estimated to be 353,000 bats (Indiana Bat Recovery Team 1999).

Male and female Indiana bats are segregated in the summer. It is not known where the majority of the bats go at this time. Males presumably roost alone or in small bachelor colonies. Most female Indiana bats begin to migrate from the hibernacula in April to form maternity colonies of up to 100 adults. Their roosts are located under the loose bark of dead, dying or mature live trees and in tree hollows. The suitability of any tree as a roost site is determined by its condition (dead or alive); quantity of loose bark; solar exposure and location relative to other trees; and spatial relationship to water sources and foraging areas. A number of tree species meet the roost site suitability requirements of the Indiana bat; the most important characteristic is probably the presence of exfoliating bark with space for the bats to roost between the bark and the bole of the tree. Researchers have discovered Indiana bats roosting in a variety of tree species (Table 1). Morphological characteristics of the tree, (i.e., dead, senescent, or severely injured from lightning strikes) make them suitable roost sites because the trees possess bark that is tenacious and springs away from the trunk upon dying (Indiana Bat Recovery Team 1999).

Table 1. Indiana bats have been found to roost in these tree species in the United States (Bat Recovery Team 1996)

<u>American Elm <i>Ulmus americana</i></u>	<u>Slippery Elm <i>Ulmus rubra</i></u>
<u>Bitternut hickory <i>Carya cordiformis</i></u>	<u>silver & sugar maples</u> <u><i>Acer saccharinum</i> & <i>A. saccharum</i></u>
<u>Shagbark hickory <i>Carya ovata</i></u>	<u>white ash <i>Fraxinus americana</i></u>
<u>Shingle oak <i>Quercus imbricaria</i></u>	<u>green ash <i>Fraxinus pennsylvanica</i></u>
<u>Red oak <i>Quercus rubra</i></u>	<u>black ash <i>Fraxinus nigra</i></u>
<u>White oak <i>Quercus alba</i></u>	<u>cottonwood <i>Populus deltoides</i></u>
<u>Post oak <i>Quercus stellata</i></u>	<u>sassafras <i>Sassafras albidum</i></u>

Female Indiana bats may arrive in their summer habitats as early as 15 April. During the early spring, a number of roosts may be used temporarily, until a roost with larger numbers is established. Most documented maternity colonies contain 100 or fewer adult bats. After grouping into nursery colonies, females give birth to one “pup” between late June and early July. Young bats are capable of flight within a month of birth (Indiana Bat Recovery Team 1999). The pups are weaned after 3-4- weeks.

Indiana bats are known to use a number of alternate roost trees in addition to the primary roost. These can be located within 100 to 132 feet of one another (Belwood 1998). Flood plains and riparian forest were considered by early researchers to be primary roosting and foraging habitats use in the summer and these forest types unquestionably are important. More recently, however, upland forest has been shown to be used by Indiana bats for roosting, and upland forest, old fields, and pastures with scattered trees have been shown to provide foraging habitat as well (Indiana Bat Recovery Team 1999). While much is know about the Indiana bat, a full, well-integrated understanding of the summer needs of this species has yet to be attained.

Indiana bats feed on flying insects. The bats tend to forage among and adjacent to tree canopies of flood plain, riparian, and upland forests. They also forage over clearings with early successional vegetation, along cropland edges and wooded fencerows, and over farm ponds in pastures (Indiana Bat Recovery Team 1999).

Background Information:

The recovery of the Indiana bat to where it is no longer endangered is ultimately dependent on maintaining protected hibernacula, appropriate roost trees and suitable mixed forest communities for foraging. Of Indiana’s nearly 23 million acres, about 20%, or 4.5 million acres, are currently forestland. Before European settlement Indiana was about 85% forested and contained nearly 20 million acres of forestland. By 1900 that acreage had been reduced to less than 2 million acres of forest or only about 7%. Since 1900 active conservation efforts and changing economies have allowed the state’s forests to recover to the current 4.5 million acre level.

The Indiana Division of Forestry manages about 150,000 total acres. This acreage constitutes about 3.4% of the state’s forest land and only about 0.7% of the total land base. While the Division’s holdings represent a small percentage of the state’s totals

they do represent some of the larger contiguous forest parcels remaining in the state as well as several Indiana bat hibernacula.

While there is limited information available about Indiana bat summer habitat needs there is a significant amount of long term information about Indiana bat hibernacula located within Indiana. The following excerpt points out both the advantages and disadvantages of the very specific winter habitat needs of the Indiana bat and the encouraging results of Indiana bat population monitoring during the last two decades.

The seasonal aggregation of Indiana bats during hibernation is important for two reasons. First, seasonal aggregations make the species extremely susceptible to man-made perturbations and natural catastrophes, and thus contribute to endangerment of the species. Second, the aggregations provide a unique opportunity to regularly census the entire population, and to monitor gains or losses by an endangered species (listed on 11 March 1967 by the U.S. Department of the Interior, Fish and Wildlife Service). Counting bats in hibernacula is relatively easy and inexpensive, and it is an extremely effective way to monitor the species.

Regular surveys of hibernacula in Indiana were begun in 1981. Except for some survey work completed in 1982, surveys have been completed every second year until present. The 1999 hibernacula survey makes 18 years of consistent, biennial monitoring in the state of Indiana..... The total number of Indiana bats hibernating in the state of Indiana (1998-99) increased to 185,899, compared to 148,940 when regular surveys were begun in 1981. The number of bats hibernating in the state has been increasing consistently since the last significant hibernaculum, Jug Hole Cave, was first surveyed in 1987.*

Some of the above increases can be attributed to the installation of “bat friendly” gates on a number of hibernacula. The Division of Forestry has been actively involved, with several public and private partners in some of the gate installations. The Division of Forestry will continue to search for and survey potential hibernacula sites on DoF property.

Furthermore, protection is afforded bats and other species that inhabit caves through the *Unlawful acts relating to caves statute* (*Indiana Code 35-43-1-3*).

MANAGEMENT STRATEGY FOR STATE FORESTS

The Division of Forestry is adopting the following management strategy to provide guidance in the conservation and enhancement of Indiana bat habitat on Division property while implementing the best management practices for water quality.

Indiana’s forests are continually maturing. Both even-aged and uneven-aged forest management practices may be incorporated on Division managed lands. In addition to sustaining healthy forest communities, forest manipulation provides habitat for early

* “1998-1999 Winter Survey for Indiana Bats (*Myotis sodalis*) in Hibernacula of Indiana” Brack and Dunlap

successional forest wildlife species. The Division is concerned about maintaining, protecting, and restoring Indiana bat maternity and foraging habitat. The Division is also obligated to provide habitats for early-, mid-, and late-successional wildlife. It is the Division's belief that tree harvesting, utilizing best management practices, on public lands is compatible with Indiana bat habitat management. In keeping with the findings of the Indiana Bat Revised Recovery Plan endorsed by the U.S. Fish and Wildlife Service and being implemented by other state natural resource agencies, the Division of Forestry will implement the following forest management strategies on its managed lands. Furthermore, as data become available, the Division will refine its management strategies to be consistent with the U.S. Fish and Wildlife Service's guidelines for the Indiana bat management, on non-federal lands.¹

Note: As referenced in these strategies the following definitions apply:

Tract -- An area of state forest, usually containing between 40 and 100 acres, with identifiable physical boundaries. Forest resource management decision-making is ordinarily done at the tract level.

Compartment -- A combination of several tracts, in close proximity to each other, ordinarily containing between 600 and 1000 acres. The compartment serves as the second tier spatial context for forest resource management decisions on state forests.

Landscape scale -- That portion of a state forest ownership, usually containing several compartments in close proximity to each other and many times containing significant private lands. These areas exhibit a similar suite of ecological conditions and management considerations.

Timber harvest -- Silvicultural practices which involve the cutting and extraction of multiple trees, from a designated area of the forest, resulting in the production of forest products and improved residual timber conditions.

1. In forests under active timber management, both even-aged and uneven-aged forest management practices may be used. Both practices provide habitats for early-, mid-, and late-successional wildlife species, including the Indiana bat.
2. Forest management practices that perpetuate hardwoods and maintain or create a diversity of age and size classes will be incorporated. Mature and over-mature trees will be well represented within all forest management compartments. As these large, old trees die and become snags, they will provide Indiana bats a continuous supply of potential roost sites. The management goal is to develop patchiness, vertical height diversity, and an adequate number of dead and dying trees within each forest management compartment.
3. In general, to ensure that best management practices can be used, no restriction on harvest dates on DoF managed land will be imposed in cases where proper precautions have been implemented to avoid impacting Indiana bats.

¹ The per acre tree retention requirements will be implemented as an average for the entire "management compartment" or designated "tract".

4. In Indiana landscapes with areas of large, contiguous, mature forest, overstory tree canopy cover will be maintained between 30 and 80% within forest management compartments and understory tree density will be managed to promote openness, as appropriate within the overall management objectives of the compartment.

In forests under active timber management, maintaining overstory tree canopy cover between 30 and 80% with even-aged and uneven-aged forest management practices will create openings and edges and allow sunlight to reach snags and potential roost trees, thus improving the suitability of the habitat for maternity colonies. Opening the overstory tree canopy also will create foraging habitat as Indiana bats preferentially forage around and adjacent to tree canopies. Maintaining an open understory with forest management practices such as thinning or timber stand improvement (TSI) would remove obstacles to flight and make snags more accessible, allow sunlight to reach the trunks of snags, and allow bats to forage under the tree canopy.

5. The following species of trees, whether dead, dying, or alive, have relatively high value as potential Indiana bat roost trees and will be encouraged for conservation:

Shagbark hickory (<i>Carya ovata</i>)	Slippery elm (<i>Ulmus rubra</i>)
Shellbark hickory (<i>Carya laciniata</i>)	American elm (<i>Ulmus americana</i>)
Bitternut hickory (<i>Carya cordiformis</i>)	Black locust (<i>Robinia pseudoacacia</i>)
Black ash (<i>Fraxinus nigra</i>)	Eastern cottonwood (<i>Populus deltoides</i>)
Green ash (<i>Fraxinus pennsylvanica</i>)	Silver maple (<i>Acer saccharinum</i>)
White ash (<i>Fraxinus americana</i>)	Sassafras (<i>Sassafras albidum</i>)
Shingle oak (<i>Quercus imbricaria</i>)	Post oak (<i>Quercus stellata</i>)
Northern Red Oak (<i>Quercus rubra</i>)	White oak (<i>Quercus alba</i>)

6. Because trees ≥ 20 inches diameter breast height (d.b.h.) are used preferentially as roost trees, within each forest management compartment and within individual management tracts which utilize uneven-aged management practices, a minimum of 3 live trees per acre ≥ 20 inches d.b.h. and 6 live trees per acre ≥ 11 inches d.b.h. (of species with characteristics similar to those listed above)(this is a minimum total of 9 live trees ≥ 11 inches d.b.h. per acre)will be maintained.¹
7. Within each forest management compartment and within individual management tracts which utilize uneven-aged management practices, a minimum of 5 snags per acre ≥ 9 inches d.b.h. and 1 snag per acre ≥ 19 inches d.b.h. will be maintained or created (A snag is a standing, dead tree)(this is a minimum total of 6 snags per acre). Oaks, hickories, and ashes will be favored for retention as snags. Upper slopes and ridge tops will be targeted for snag retention. During timber harvests, snags will not be removed except where they constitute a human safety hazard.¹

8. Whenever practical, retention of shagbark hickory and shellbark hickory as a forest component will be encouraged because of their value as potential roost trees.
9. When a human safety hazard, dead trees will be removed. Given this policy, special consideration will be given to the possibility of encountering Indiana bats. The best way to ensure that Indiana bats are not roosting in a tree when it is removed is to cut trees between 16 September and 14 April, when Indiana bats are hibernating in inactive mines and caves (dates may be revised in accordance with U.S. Fish and Wildlife Service guidelines). If it becomes necessary to remove a dead tree between 15 April and 14 September for public safety, efforts will be made to ensure that bats will not be harmed. Where practical, potential roost trees will be examined at dusk, when bats leave their roost tree to forage. Safety hazard, dead trees from which Indiana bats are observed emerging will not be cut during the summer months.
10. Within riparian corridors, a forested buffer strip will be maintained. The buffer will be a minimum of 100 feet on each side of perennial streams or rivers and a 50 foot buffer will be maintained on each side of intermittent streams (dashed blue-line streams), for at least 80% of the stream's length. The DoF recognizes that some trees may need to be cut within a buffer strip. However, the integrity of the corridor will be maintained and only minimal cutting may occur after a thorough evaluation of the trees as potential roost sites. Tree planting or reforestation projects will be encouraged along riparian corridors.
11. Around all known "active" Indiana bat hibernacula, 20 acres (where ownership permits) of forest will be designated as an area where timber harvest will not occur. Corridors of tree canopy from the hibernacula to foraging areas will be maintained (where possible). [A known Indiana bat hibernacula will be considered "active" if any hibernacula survey within the previous six (6) years documented 10 or more Indiana bats present within the hibernacula.]
12. Within 5 miles of any Priority One or Priority Two (≥ 500 bats) hibernacula, a minimum of 10% of the Division of Forestry (DoF) ownership will be designated as an area where timber harvest will not occur. The number of snags and roost trees within this 5-mile area will be periodically monitored. Within the 5-mile area, in forests under active timber management, even-aged management and/or uneven-aged forest management practices will be used to maintain or create snags in a diverse age-size class distribution.
13. Dead trees with tight bark may be removed during salvage harvests as they offer little potential as Indiana bat roost trees. Because Indiana bats roost only in standing trees, trees that have fallen to the ground may be salvaged regardless of bark condition.
14. Construction projects or other activities on DoF properties that may impact Indiana bat habitat, will be assessed on a case by case basis. DoF personnel will first determine if suitable roost trees occur within the project limits, suitable trees include dead and dying trees of the species listed above with exfoliating bark, crevices, or cavities in upland areas or riparian corridors and living trees of the species listed

above with exfoliating bark, cavities, or hollow areas formed from broken branches or tops. When suitable trees occur within the project limits, where practical, trees will be conserved as outlined for the Division's active timber management lands. In addition,

- If suitable habitat occurs and trees must be cut, the DoF recommends cutting occur between 15 September and 14 April (dates may be revised in accordance with U.S. Fish and Wildlife guidelines), or
- If suitable trees must be cut during the summer months (15 April to 14 September) efforts will be made to ensure that bats will not be harmed. Where practical, potential roost trees will be examined at dusk, when bats leave their roost tree to forage. Trees in which Indiana bats are actively roosting will not be cut.
- Construction zone will be examined for potential Indiana Bat hibernacula.

This management strategy is based on current knowledge of Indiana Bat management and habitat requirements and may be modified to reflect new information as it becomes available.